PATENT SPECIFICATION

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COMPLETE SPECIFICATION

A Centring Device for Centring Conduits and the like in Well Bores

We, BAKER OIL TOOLS, INC., a corporation duly organized under the laws of the State of California, of 6000, South Boyle Avenue, Los Angeles, State of California, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement :—

The present invention relates to devices for maintaining casing, liner and similar conduit strings spaced from the walls of an encompassing well bore.

An object of the present invention is to provide an improved rigid well conduit centring device capable of positively maintaining an adequate clearance space between the conduit and the wall of the well bore containing the conduit.

Another object of the invention is to provide a rigid centring device for a well conduit that is strong and sturdy, despite the comparative lightness of the materials from which it is made, and which is also relatively economical to manufacture.

A further object of the invention is to provide a rigid centring device for well casing, and similar conduit, strings which tends to prevent channelling of cement slurry deposited behind the casing string.

According to the present invention there is provided a centring device for centring conduits and the like in well bores having upper and lower longitudinally spaced collars, including a plurality of circumferentially spaced ribs extending between said collars, each rib being channel-shaped in cross section with a mid-section generally parallel to the axis of said collars and with tapered end portions secured to said collars.

One particular embodiment of the present invention is shown in the drawings accompanying and forming part of the present specification. It will now be described in detail, for the purpose of illustrating the general principles of the invention; but it is to be understood that such detailed description is not to be taken in a limiting sense, since the scope of the invention is defined by the appended claims.

Referring to the drawings :

Figure 1 is a side elevation of a centring device mounted on a casing string disposed in a well bore ;

Figure 2 is a cross-section taken along the line 2—2 on Figure 1 ;

Figure 3 is a fragmentary longitudinal section taken along the line 3—3 on Figure 2 ;

Figure 4 is an isometric projection of one of the rib members forming part of the centring device ;

Figure 5 is a top plan view of a blank from which one of the rib members is formed.

The device illustrated in the drawings is a rigid type of centring device A that can be mounted on or made to form part of a casing, liner or similar conduit string B disposed in a well bore C.

Such a centring device maintains the conduit string spaced from the wall of the well bore in a comparatively centred position, particularly when the diameter of the well bore is substantially greater than the outside diameter of the casing string, or of its coupling collars.

The centring device may include longitudinally spaced end rings or collars 10, 11, to which a plurality of circumferentially spaced and longitudinal extending ribs 12 are secured. The collars 10, 11 are slidable on the casing string B, or they may be rigidly attached thereto, as desired.

The ribs are comparatively rigid and are designed to withstand lateral deformation in the event that the casing string leans against the formation wall with a comparatively great force. Despite its rigidity, each rib is preferably made of light gauge sheet material, such as sheet steel, or other

sheet metal. In order to impart rigidity to the relatively thin sheet metal, it is formed into a generally channel shape, consisting of a mid-section 13 and tapered end sections 14, 14. The mid-section and end sections include a central web portion 15, which has a convex exterior, and flange portions 16, 16 projecting in the same direction from the web portion 15, to produce a generally U-shape cross-sectional member, as disclosed most clearly in Fig. 2.

The end sections 14 are preferably tapered, with their terminal portions 14*a* snugly fitting the exterior of the collars 10, 11 to which the ribs 12 may be permanently secured, as by the aid of a bead of welding material 17 that may run entirely around each collar, in order to integrate the end portions thereto.

The tapered end portions 14 may be made of any suitable length, for appropriately spacing the mid-sections 13 relative to the periphery of the casing string B, and thereby determine the effective diameter of the centring device in holding the casing string spaced from the wall of the well bore C. Of course, the farther from the casing string the mid-sections 13 are placed, the larger is the diameter bore hole in which the device can be used effectively.

Each channel or trough-shaped rib 12 may be formed from a sheet metal blank 18, such as disclosed in Fig. 5. This blank has a mid-portion 13 and end portions 14 between which generally V-shaped notches 19 are provided. The corners 20 of the end portions 14 are bevelled, so that such bevelled members may lie flush against the end collars 10, 11 when mounted thereon.

In order to form the trough-shaped member 12, such as illustrated in Fig. 4, the blank 18 is bent generally along the fold lines *r* in the same direction, to form the channelled flanges 16 and web 15 for both the mid-section 13 of the rib and its tapered end portions 14. The web portions 15 are also given the curved or arcuate configuration, while the bends about the lines *r* may also possess a radius to avoid sharp external corners. The end portions 14 are also bent along the fold lines *s* until the sides of the V-shaped notches 19 engage one another, which determines the extent of inclination of the tapered end portions 14 with respect to the mid-section 13. The ends 14*a* of the blank are also bent, so that their curvature conforms to the curvature of the collars 10, 11 on which the ends 14*a* are to snugly engage, in order to ensure a proper weld to the collars.

All of the foregoing bending and folding operations can take place at the same time by providing a suitable forming die. The curvature of the webs 15, the bending of the flanges 16, and the bending of the tapered portions 14 about the fold lines *s*, together with the proper curving of the terminals 14*a* of each rib to fit the collars 10, 11, is performed by a single stroke of a die member towards its mating die member. In addition, the excess metal at the ends of the blank is trimmed off by a suitable shearing device after the rib 12 has been formed.

The mid-section and end section flanges 16 are then welded to one another along their abutting joints 21, to integrate the flanges and to produce a rigid structure. The ribs 12 are then welded onto the end collars 10, 11, completing a centring device.

The centring device A is slid over the end of a casing section and may be firmly secured thereto, if desired, by means of welding material, or set screws (not shown), attaching one or both of the collars 10, 11, to the casing. If desired, a suitable stop ring (not shown) may be welded to the casing string B to one side of the centring device, such ring engaging the centring device A and moving it through the well bore with the casing string. For that matter, a casing coupling collar itself (not shown) can function as a stop member, forcing the centring device through the well bore.

The lateral outward projection of the centring device causes its web portions 13 to engage the wall of the well bore C, and hold the casing string properly spaced with respect to the well bore. The channel shape of each rib 12 makes it extremely rigid, since the flanges 16 afford proper support to the formation wall engaging webs 15. The inward thrust is transmitted from the central web 15 to the flanges 16 of the mid-section and through these flanges to the end flanges 16 which bear against the collars 10, 11. The weld 17, of course, prevents longitudinal displacement of the ribs 12 with respect to the collars 10, 11.

The provision of an adequate clearance space around the casing string ensures that any cement slurry, or other cementitious material, deposited behind the casing string B will be able to completely encompass the latter, offering far better chance for a successful cementing job. In addition, the circumferentially spaced ribs 12 form baffles or restrictions for the cement slurry, and cause it to deviate laterally around the casing string for upward passage along the casing string between the ribs 12, or produce acceleration of the slurry between the ribs and the formation wall. Such lateral deviations and accelerations tend to prevent channelling of the cement slurry, and offer greater assurance for the circumferential continuity of the cementitious seal.

If desired, a duplicate centring arrange-

ment can be used, as disclosed in Fig. 1. With this arrangement, another set of ribs 12*a*, as a lower set, are longitudinally spaced with respect to a single set of ribs 12, such as an upper set. The lower collar 11 for the upper set of ribs may be elongated to enable the upper ends of the lower ribs 12*a* to be welded thereto. The lower ends of these last-mentioned ribs may be welded to a lower collar or ring 30.

The lower set of ribs 12*a* is angularly displaced with respect to the upper set 12. Assuming that each set has three ribs, and that each rib extends about sixty degrees around the casing string, the lower set may be displaced about sixty degrees with respect to the upper set. As a result of this arrangement, the upper and lower sets of ribs 12, 12*a* together provide about a 360 degree contact surface with the formation wall, increasing the capacity of the centring device, and ensuring that the web portions 15 of the ribs will have adequate bearing against the formation wall, regardless of the lateral direction in which the casing string B tends to lean against the formation wall.

Not only does the staggered arrangement of the two sets of ribs 12, 12*a* increase the load carrying capacity of the device considerably, but it also forms a tortuous path for the cement slurry during its upward travel around the casing string. Such slurry will pass upwardly between the ribs 12*a* of the lower set, but must then move arcuately, in order to pass between the ribs 12 of the upper set. This staggered arrangement also minimizes the chance of channelling of the cement slurry, and enhances the obtaining of the circumferentially continuous cementitious seal around the casing string.

It is, accordingly, apparent that centring devices have been provided which can be manufactured in a comparatively economical manner, and in which light gauge sheet materials are availed of to provide a strong and sturdy construction. The arrangement is such as to keep the casing adequately displaced from the wall of the well bore around the entire circumference of the casing, the centring ribs themselves minimizing the tendency for the cement slurry to channel while being displaced behind the casing.

What we claim is :—

1. A centring device for centring conduits and the like in well bores having upper and lower longitudinally spaced collars, including a plurality of circumferentially spaced ribs extending between said collars, each rib being channel-shaped in cross section with a mid-section generally parallel to the axis of said collars and with tapered end portions secured to said collars.

2. A centring device for centring conduits and the like in well bores as set forth in claim 1, in which each rib is provided with an inwardly facing web including a medial portion and said end portions, each rib also having medial and end flanges secured to and extending inwardly from said medial and end web portions, said medial and end flanges being welded to each other.

3. A centring device for centring conduits and the like in well bores as set forth in claim 2, in which each of said ribs comprises a single piece of sheet metal.

4. A centring device for centring conduits and the like in well bores as set forth in claims 1 or 3, including an intermediate collar longitudinally spaced from the upper and lower collars and a lower set of circumferentially spaced ribs extending between and secured to the lower collar and intermediate collar, said upper set of ribs extending between and secured to the upper collar and said intermediate collar.

5. A centring device for centring conduits and the like in well bores as set forth in claim 4, in which said sets of ribs are circumferentially offset with respect to each other.

6. A centring device for centring conduits and the like in well bores as set forth in claim 5, in which said sets of ribs collectively extend around substantially the entire circumference of the centring device.

7. A centring device for centring conduits and the like in well bores, substantially as described, and as shown in the accompanying drawings, and for the purpose set forth.

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682,362 COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

FIG. 1.

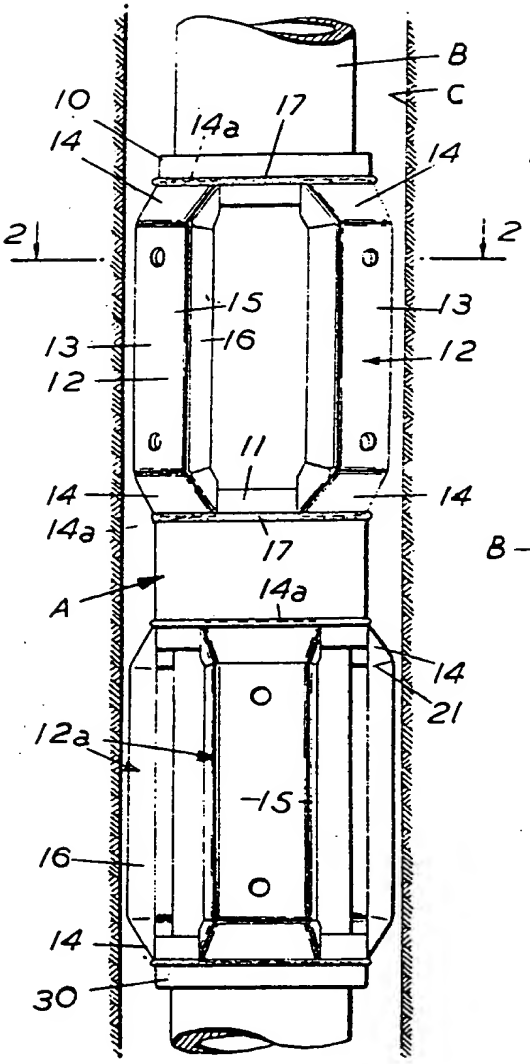
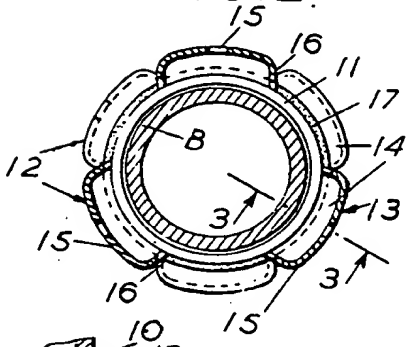


FIG. 2.



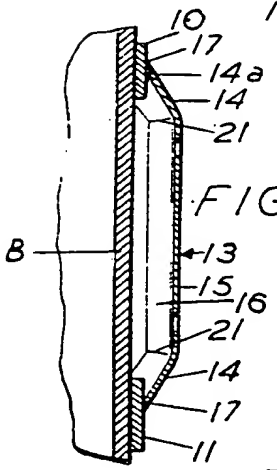
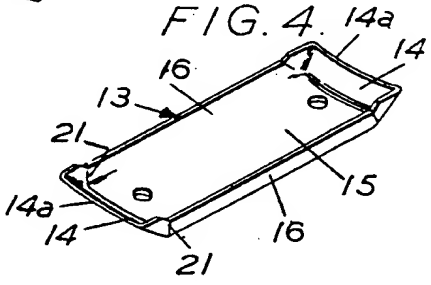


FIG. 3.

FIG. 4.



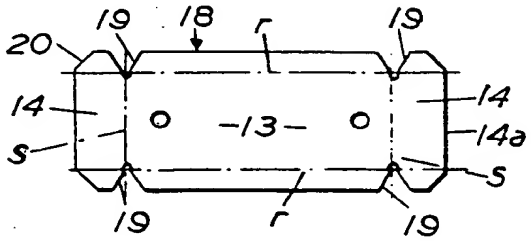


FIG. 5.